Syllabus prescribed for
M.Tech. (Chemical Engg.)

1 CE 5 Elective - I

4) Chemical Process Intensification

Definition of Process Intensification (PI). Benefits of PI. Techniques for PI application: active and passive techniques.

Spinning disc reactor : Operating principle and development of models for thin film flow on rotating disc. Examples of application of SDR to a range of processes.

Rotary packed bed : Operating principle of rotating contactors. Development of models for counter-current multiphase flow in rotating systems. Examples of the application of multiphase contactors.

Oscillatory flow reactor : Description & operating principles. History. Explanation of niche applications. Design. Case studies.

Compact heat exchangers : Definition of CHEs. Construction and main properties. Applications. Basic design procedures. Examples.

Micro-reactors: Description and operating principles. Heat transfer, mass transfer and mixing applications.

Catalytic plate reactors : Principles of operation. Case studies of applications.

Recommended Books:

1. Process Intensification: David Reay, Colin Ramshaw, Adam Harvey Butterworth Heinemann AUG-2008
2. Wang, Y.; Holladay, J.D. (Eds.): Microreactor Technology and Process Intensification (ACS Symposium Series No. 914), ACS Publ. (2005)
3. Jachuck, R. (Ed.): Process Intensifi cation in the Chemical and Related Industries, Blackwell, Oxford
4. Galip Akay : Bioprocess and Chemical Process Intensification, Encyclopedia of Chemical Processing, Published on 30 November 2005

2 CE 5 Elective - II

4) Computational Fluid Dynamics

Conservation Laws of Fluid Motion and Boundary Conditions: Governing equations of fluid flow and heat transfer, Equations of state, Navier-Stokes equations for a Newtonian fluid,

Classification of physical behaviour, Classification of fluid flow equations, Auxiliary conditions for viscous fluid flow equations
Turbulence and its Modelling: Transition from laminar to turbulent flow, Effect of turbulence on time-averaged Navier-Stokes equations, Characteristics of simple turbulent flows, Free turbulent flows, Flat plate boundary layer and pipe flow, Turbulence models, Mixing length model,The k-e model, Reynolds stress equation models, Algebraic stress equation models

The Finite Volume Method for Diffusion Problems: Introduction, one-dimensional steady state diffusion, two-dimensional diffusion problems, three-dimensional diffusion problems, discretised equations for diffusion problems

The Finite Volume Method for Convection-Diffusion Problems: Steady one-dimensional convection and diffusion, The central differencing scheme, Properties of discretisation schemes-Conservativeness, Boundedness, Transportiveness, Assessment of the central differencing scheme for convection-diffusion problems, The upwind differencing scheme,

One-dimensional unsteady heat conduction, Discretisation of transient convection-diffusion equation, Solution procedures for unsteady flow calculations, Implementation of Inlet, outlet and wall boundary conditions, constant pressure boundary condition.

Books:

1. Anderson, J.D. Jr., "Computational Fluid Dynamics", McGraw Hill Inc., 1995
2. Hoffman, K.A. and Chaing, S.T., "Computational Fluid Dynamics", Engineering Education System, Kanasa, USA, 1993
3. Chung, T.J., "Computational Fluid Dynamics", Cambridge University Press, 2003
4. John D. Anderson, Computational Fluid Dynamics: The Basics with Applications McGraw-Hill, .New York, 1995.
5. Vivek V. Ranade, Computational Flow Modeling for Chemical Reactor Engineering Academic Press, San Diego, 2002

CHANGES IN COURSE CONTENT SUGGESTED

2 CE 2 Advanced Separation Techniques

Reveiw of conventional processes, Recent advances in separation techniques based on size, surface properties, ionic properties and other special characteristics of substances, Process concept, Theory and equipment used in cross flow filtration, cross flow electrofiltration, dual functional filter, Surface based solid - liquid separations involving a second liquid, Sirofloc filter.

Types and choice of membrances, Plate and frame, tubular, spiral wound and hollow fibre membrance reactors and their relative merits, Commercial, pilot plant and laboratory membrance permeators involving dialysis, reverse osmosis, Nanofiltration, ultrafiltration, Microfiltration and Donnan dialysis, Economics of membrance operations, Ceramic membrances.

Mechanism, Types and choice of adsorbents, Normal adsorption techniques, Affinity chromatography and
immuno chromatography. Types of equipment and commercial processes, Recent advances and process
economics.

Controlling factors, Applications, Types of equipment employed for electrophoresis, Dielectrophoresis, Ion exchange chromatography and electrodialysis, Commercial Processes.

Separations involving Iyophilisation, Prevaporation and permeation techniques for solids, liquids and gases. Industrial viability and examples, Zone melting, Addluctive crystallization, Other separation process, Supercritical fluid extraction, Oil spill Management, Industrial effluent treatment by modern techniques.

Books:

1. Lacey, R.E. and S.Loaeb - " Industrial Processing with Membranes ", Wiley-Inter Science, New York, 1972.
2. King, C.J. " Separation Processes ", Tata McGraw - Hill Publishing Co., Ltd., 1982.
3. Schoew, H.M. - " New Chemical Engineering Separation Techniques ", Inter Science Publishers, 1972.
4. Ronald W.Roussel - " Handbook of Separation Process Technology ", John Wiley, New York, 1987.
5. Kestory, R.E. - " Synthetic Polymeric Membranes ", Wiley, New York, 1987.
6. Osadar, Varid Nakagawa I - " Membrane Science and Technology ", Marcel Dekkar (1992).

Remaining content of syllabi is as per the syllabi of 2009-10 of M.Tech. (Chemical Engg.)

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